CLAIMS

What is claimed is:

1. A method of making a multi-layer, thin film composite which comprises:

(A.) depositing onto a substrate a precursor composition for a buffer layer, the composition comprising an organic solvent, a polymeric heterocyclic amide and organic metallic compounds;

(B.) heating the product of step (A.) to render a composite of a buffer layer and substrate;

(C.) depositing onto the product of step (B.) a precursor composition for a dielectric thin film layer comprising an organic solvent and organometallic compound;

(D.) heating the product of step (C.) to render a composite wherein the buffer layer is between the substrate and the dielectric thin film layer; and

(E.) annealing the product of step (D.).

2. The method of Claim 1, wherein the polymeric heterocyclic amide is polyvinyl pyrrolidone.

3. The method of Claim 1, further comprising annealing the product of step (D.) at a temperature between from about 550° C to about 750° C.

4. The method of Claim 1, wherein the buffer layer of step (B.) has a thickness of between about 20 to about 300 nm.

5. The method of Claim 4, wherein the dielectric thin film layer has a thickness between from about 50 to about 900 nm.

6. The method of Claim 5, wherein the thickness of the dielectric layer is greater than the thickness of the buffer layer.

7. The method of Claim 6, wherein steps (C) and (D) are repeated such that the dielectric thin film layer comprises a multitude of layers.

8. The method of Claim 2, wherein the buffer layer and the dielectric thin film layer contain some of the same elements.

9. The method of Claim 2, wherein the buffer layer and/or the dielectric thin film layer is selected from the group consisting of a lead lanthanide titanate, lead titanate, lead zirconate, lead magnesium niobate, barium titanate, lead zirconate titanate, barium strontium titanate, lanthanum-modified lead zirconate titanate, bismuth zinc niobate and bismuth strontium tantalite.

10. The method of Claim 9, wherein the dielectric thin film layer comprises lead zirconate titanate, barium strontium titanate, lanthanum-modified lead zirconate titanate, bismuth zinc niobate and/or bismuth strontium tantalite.

11. The method of Claim 9, wherein the buffer layer and/or the dielectric thin film layer is of the formula $(Ba_{1-x}Sr_x)TiO_3$, $PbZr_{1-x}Ti_xO_3$ or $Pb_yLa_z(Zr_{1-x}Ti_x)O_3$ wherein x is between from about 0.1 to about 0.9, y is from about 0.95 to about 1.25 and z is between from about 0 to about 0.15.

12. The method of Claim 11, wherein x is between from about 0.30 to about 0.70.

13. The method of Claim 9, wherein the buffer layer and/or dielectric thin film layer is of the formula $Bi_{3x}Zn_{2(1-x)}Nb_{2-x}O_7$ wherein x is between from about 0.40 to about 0.75.

14. The method of Claim 9, wherein the buffer layer and/or the dielectric thin film layer is of the formula $Sr_xBi_yTa_2O_{5+x+3y/2}$ wherein x is between from about 0.50 to about 1.0 and y is between from about 1.9 to about 2.5.

15. The method of Claim 1, wherein the substrate is selected from the group consisting of a semiconductor, glass or a metallic foil.

16. The method of Claim 15, wherein the semiconductor contains a Group 3-4 or 13-14 metal and the metallic foil is selected from the group consisting of aluminum, brass, nickel alloy, nickel-coated copper, platinum, titanium and stainless steel foil.

17. The method of Claim 7, wherein the dielectric thin film layer is composed of several dielectric layers in a regular or irregular superlattice structure, the elements in each dielectric layer being the same.

18. A ferroelectric multi-layer thin film composite comprising a metallic substrate and at least one crystalline layer prepared by the process of Claim 1.

19. A method of making a multi-layer ferroelectric thin film composite which comprises:

(A.) depositing onto a substrate a precursor composition for a buffer layer containing polyvinylpyrrolidone, and heating until forming a buffer layer having a thickness between from about 20 to about 300 nm;

(B.) depositing onto the buffer layer a second precursor composition for a dielectric thin film layer and heating until a thin film layer having a thickness of from about 50 to about 900 nm is formed, the thickness of the dielectric thin film layer being greater than the thickness of the buffer layer; and

(C.) annealing the product of step (B.) at a temperature between from about 550° C to about 750° C

further wherein the precursor composition for the buffer layer is deposited by sol-gel and contains polyvinylpyrrolidone.

20. A ferroelectric thin film capacitor, memory device, pyroelectric sensor device, wave guide modulator or acoustic sensor containing the multi-layer thin film composite of Claim 19.